NATIONAL WEATHER SERVICE - MEDFORD, OREGON

Summer 2015

Volume 4, Issue 2

THE CRATER CHRONICLE

Warning Coordination Meteorologist Ryan Sandler (back row, no hat) hosts a dozen "Shady Ladies" from the Red Hat Society.

Throughout the years the National Weather Service Office in Medford has given office tours to many organizations. We've hosted weather and safety presentations and led office tours for groups such as aviation clubs, the public, federal/state/local agencies, the Coast Guard, students from preschool to college level, and Boy Scouts.

We recently hosted the Southern Oregon Chapter of the Red Hat Society known as the "Shady Ladies." The Red Hat Society is a unique group where members who have attained the fabulous age of 50 wear red hats and purple clothing, while those under 50 wear pink hats and lavender clothing. The Shady Ladies showed a great curiosity about weather forecasting and severe weather, and were a pleasure to host.

If you are a member of a group that is interested in visiting our office and/or watching the weather balloon go up at 4 pm (during daylight savings time) please contact Ryan Sandler at 541-776-4303 #223 or email ryan.sandler@noaa.gov

INSIDE THIS ISSUE

Summer Began June 21 at 9:38 am PDT.

Climate Change: Climate Models

John Lovegrove, Meteorologist-In-Charge

In the last issue of the *Crater Chronicle*, I discussed the relationship of day-to-day weather with climate change. The topic for this issue is climate models. Many can wonder how a computer model can forecast what will happen with climate years into the future when weather computer models can only reach out about ten days. This is a valid question considering the similarities between the two models. While the two share many equations and model the same physical properties, the end results from the models are quite different.

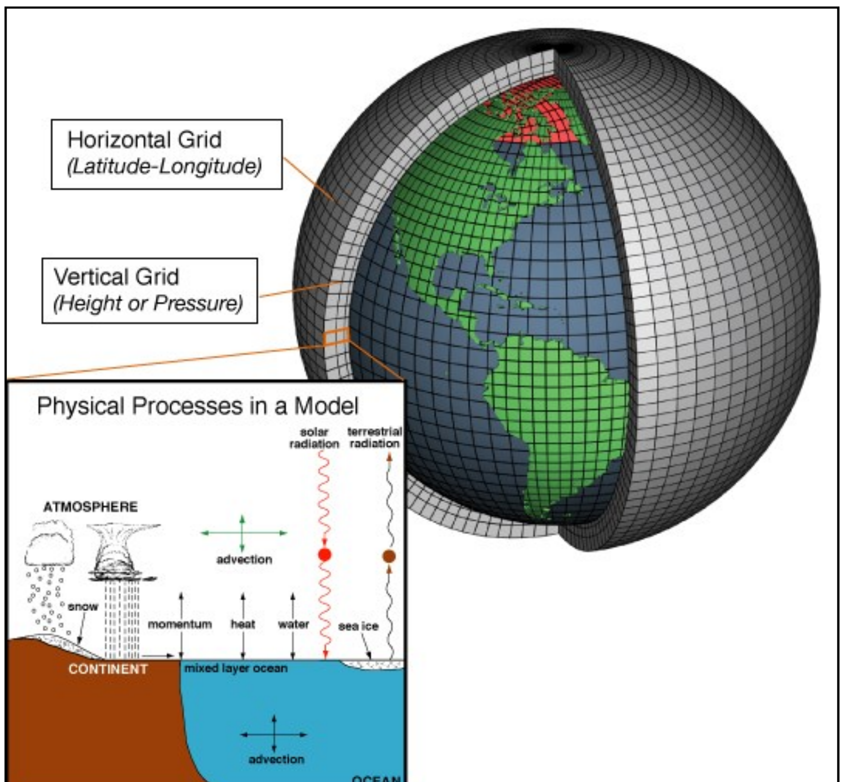
The National Weather Service uses several different weather models on a daily basis. If you are a regular reader of our forecast discussions, some of the names will sound familiar. The most common ones we use are the Global Forecast System (GFS), North American Model (NAM) and the European Centre for Medium-Range Weather Forecasting (ECMWF or simply EC). These models are incredibly complex requiring some of the most sophisticated supercomputers in the world to make the trillions of computations for each run. The goal of these models is to precisely track each weather feature within the domain of the models. In the case of the GFS, the model tracks weather out to 240 hours, or 10 days, over the Northern Hemisphere. A daily weather model is called initial condition dependent. The model requires an accurate snapshot of what is going on with the weather right now in order to move and develop weather through time. The weather balloons we launch twice a day from Medford are part of this snapshot. It is impossible to have a completely accurate initial starting point for the model. The errors in the initial conditions are what leads to eventual errors in the forecast.

We even use the inevitability of error to help make better forecasts. The technique is called ensemble forecasting. The model is run several times with very small changes (perturbations) made in the starting point each time. These changes can be in wind, temperature, humidity or any other weather element forecast by the model. We can then compare how each perturbation affects the output. If there is a consensus, that is a likely accurate prediction.

Climate models run over the entire globe at a more coarse resolution. The goal of these models is not to track every weather feature over time but to track the average condition, create a trend and provide statistics. Whether or not a cold front will come on shore in mid-January 2150 is not important. At that time range, what is important is what will the winter of 2149-50 be like or the decade of the 2140s. This is determined not by individual storms but the total global energy balance. Because a high level of detail is not important, the initial conditions are not so important. These models are boundary condition dependent. They depend upon knowing items such as: how much heat will be provided by the Sun, what is the chemical makeup of the atmosphere, and the temperature structure of the oceans. These boundary conditions are more stable and easily measured as compared to the initial conditions of a daily weather model. Because of that, the climate model can accurately predict *average* conditions over a long period of time.

All models have errors - it is inevitable. The earth's atmosphere and oceans are just too complex to capture every nuance. But, the climate models do a great job due to the skill of the programmers and calibration of the model. A climate model is calibrated or tuned by running for a long period of time with stable boundary conditions to ensure there is no drift. When the output is stable, the model is in balance and tuned. Then, changes can be introduced to the boundary conditions to see what effect it will have over time.

I wouldn't say that comparing weather models to climate models is similar to comparing apples to oranges. It's more like comparing apples to pears - there are similarities but also some very important differences.



Depiction shows how the Earth is broken up into grids for a climate model to run it's calculations. Source: http://celebrating200years.noaa.gov/breakthroughs/climate_model/welcome.html

Lightning: It'll Change Your Life in a Flash!

Brad Schaaf, Meteorologist Intern

Summer is prime time to enjoy the outdoors as the weather heats up and the outdoors beckon us with majestic beauty. It's also the ideal time for thunderstorms to develop across southwestern Oregon and northern California. This mix can put people in dangerous situations that are often times preventable. Each year, hundreds of people in the United States are struck by lightning; and tragically, 35 people are killed on average. Because thunderstorms are not a part of everyday life, lightning safety awareness becomes even more crucial.

The formation of lightning is a complex process where ice crystals, hail, and rain drops in cumulonimbus clouds collide with each other. This collision process helps to charge these particles in the same way shuffling along carpet on a dry day builds static electricity. When enough charge builds up, the electricity will produce an arc—similar to the zap one may feel when shocked—to discharge the built up electricity. Each bolt of lightning has the ability to heat up the surrounding air to 5 times the temperature of the surface of the sun! This quick heating causes the air to expand rapidly, in turn causing the loud crash of thunder.

Lightning will almost always travel the path of least resistance. This means that there are several ways a person can be struck. The most straight forward way to be injured by lightning is to be struck directly. This generally occurs when the person is the tallest object in an area, i.e. open fields. Being directly struck, however, is uncommon. More commonly, people can be struck indirectly by lightning which has traveled over a long distance. This stems from people taking shelter near taller objects like trees, pavilions or garages; or people are touching objects that conduct electricity over long distances—like fences. In addition, lightning could strike the object and travel into the ground before entering the person.

When a person is struck by lightning, the amount of electricity overwhelms the body's nervous system, resulting in brain and nerve injuries. Although each injury will be different, many people experience muscle soreness, headaches, nausea, dizziness, balance problems, confusion, memory slowness, or mental cloudiness. In some circumstances, cardiac arrest may also occur at the time of strike. If this occurs, administer first aid immediately. The human body does not store electricity, so there is no danger of being electrocuted by the victim. Although most of the aforementioned symptoms could go away after some time, a few long term problems may persist or develop. Such problems include memory issues, slower reaction times, irritability or personality change, chronic pain, dizziness, depression, and difficulty sleeping.

So what can be done do to prevent these tragedies? It all starts with making a plan: Follow the weather forecast and plan your activities accordingly. If possible, postpone outdoor events and activities for days when thunderstorms aren't in the forecast. If you are outdoors and you hear thunder, you are already at risk of being struck by lightning. Seek shelter in a permanent structure or a hard-topped, metal-framed vehicle. The frame of the car, not the tires, will provide protection. When indoors, refrain from using corded elec-

tronics like telephones or video games and stay away from plumbing. Abstain from washing dishes or your hands during this time as electricity can flow through the metal piping. Also, don't go outside to take pictures or just to watch the storms approach. There is no safe place outside during a thunderstorm, and this includes the front porch or a garage.

Sometimes, waiting to hear thunder will not provide enough time to seek shelter. This is especially true for those who are working, hiking, camping, fishing, golfing, or otherwise enjoying the outdoors. It is important to make a plan to seek shelter at the sight of ominous clouds before you even hear thunder. If you are caught outdoors and cannot make it to sufficient shelter, try to avoid open areas. Avoid the tallest objects in the area, and refrain from taking shelter under tall, isolated trees or open pavilions. If you are in the woods, put as much distance between you and any tree as you can. If you are in a group, spread out so that you increase the chances for survivors to aid of any victims of a lightning strike.

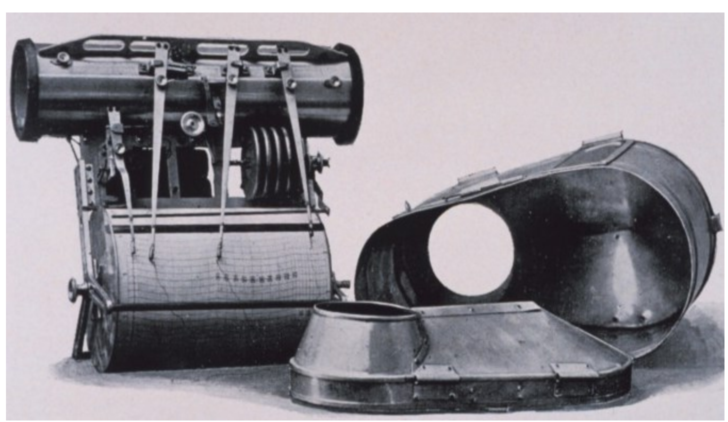
Almost all lightning injuries are preventable. Although thunderstorms only occur around 10 to 20 days of the year in our area, it is important to remember to be safe during thunderstorm season. Don't let lightning change your life in a flash; when thunder roars, go indoors!

Upper-Air Observations over the Centuries

Misty Duncan, Meteorologist Intern

Every day, twice a day at midnight and noon Greenwich Mean Time (GMT), numerous stations around the world release balloons that carry radiosondes up to the edge of the earth's atmosphere. A radiosonde is a box of instruments that measure temperature, relative humidity, and pressure. Once far enough off the surface, the balloon is tracked automatically by a computer using GPS. Data is transmitted in real-time through radio signals that are received by an antenna back at the earth's surface. A computer processes these signals and translates them into legible information that we can understand. At certain levels in the atmosphere, the computer generates reports that summarize the data and with a click of a button, these reports are sent to where they need to go. Aside from the physical preparation and release of the balloon, the computer does most of the "heavy lifting". The observer's main role is to quality control the incoming data. This was not always the case…

The process of taking upper-air observations has come a long way since they first began in the mid-1700s. Original observations during this time involved kites that carried thermometers aloft to record the temperature. The inventions of hot air and hydrogen balloons allowed for manned flights where scientists brought instruments to measure temperature, relative humidity, and pressure as they ascended aloft. This had its limitations; the scientists were exposed to extreme temperatures and lack of oxygen. Kite observations posed less risk and continued into the 1800s in which a meteorograph was used to obtain atmospheric data. A meteorograph is a device used to measure specific properties of the atmosphere, such as temperature, humidity, and pressure, at the same time with an automated clockwork driven chart recorder.

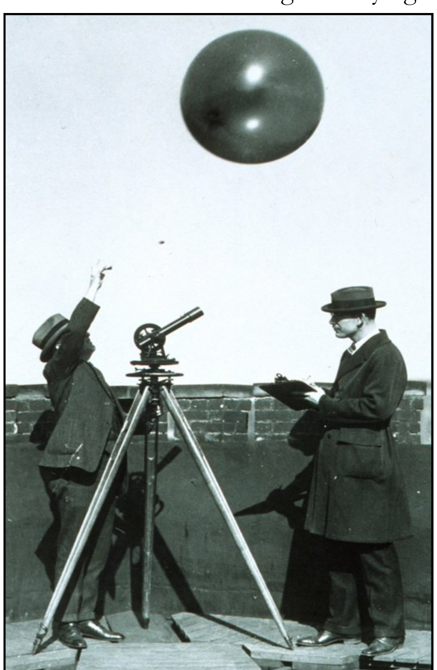


Late 1800's Marvin Meteorograph. Photo courtesy: Historic NOAA Photo Collection.

While the kite method of observation provided valuable information, there were also numerous limitations. These "kites" were over 6 feet tall and were attached to a steam-driven reel with piano wire that anchored them to the ground. This limited the height which the kite could ascend to typically less than 2 miles. Compare this to today's balloons that can reach heights upwards of 20 miles. Kites could not be launched in strong winds or poor weather. Also, the data were not available in real time because the meteorograph observations weren't available until the kite was reeled in.

Picture shows the kites and steam-driven reel (right) that anchored them to the ground. Photo: Historic NOAA Photo Collection

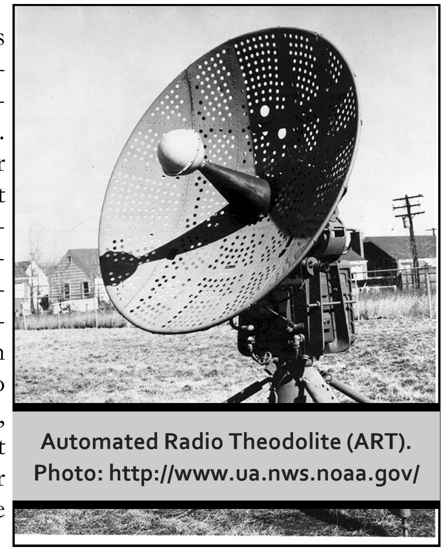
These limitations pushed scientists to develop improvements and during the early 1900s, meteorographs became light enough to be carried aloft by free, unmanned balloons. Being unanchored, these balloons could reach much higher: up to the stratosphere which is roughly 7 miles high in the mid-latitudes. The downside to this method was that once the balloon had burst, the meteorograph had to be found to retrieve the data. This could take took days or even weeks! So again, the data wasn't available in real time. Aircraft also began carrying meteorographs during this time but were also limited by poor weather and observations weren't obtained until the aircraft landed. Wind data could be obtained by releasing small, free balloons called pilot balloons and tracking them with a theodolite. A theodolite is a specialized instrument that measures vertical and horizontal angles which were used to calculate wind speed and direction. This was very labor intensive, requiring an observer to constantly keep track of the ball with another observer recording the data. It was also another method limited by poor weather since it was easy to loose site of the balloon due to low clouds or poor visibility.



Depiction of a theodolite and the pilot balloon. Photo: Historic NOAA Photo Collection.

These constant limitations led to the development of the radio transmission of upper air data by the early 1930s. Scientists began suspending simple radio transmitters from free balloons and the first radio-meteorographs, or "radiosondes" were reaching into the stratosphere. WWII brought about technological advances that significantly improved radio tracking. These advances allowed the balloon to be tracked during the flight so that atmospheric data, including wind data, were retrieved in real time.

By the 1950s automated radio-theodolite (ART) systems were implemented. The lack of computer processing systems at the time kept this process a very labor intensive and time consuming task. It usually involved two people with a third person acting to quality control the data, help during difficult weather conditions or analysis, and to oversee the procedures.



Automated Radio Theodolite (ART). Photo: http://www.ua.nws.noaa.gov/

During the 1960s-1970s efforts were made to ease the workload of taking a radiosonde observation, or RAOB. In the 1980s, significant advances in telemetry and computers allowed for RAOBs to be fully automated. Acquiring, processing, and disseminating flight data could all be done automatically and required minimal observer involvement; making the RAOB a one person show. In addition to data processing advancements, new advancements became available in tracking wind data using radio-navigation aids (NAVAID).

In the 1990s, advancements continued with improved radiosondes, data processing systems, and NAVAID systems. Radiosondes were developed to use GPS location to derive winds and in the late 1990's, the NWS began replacing the ART ground systems with GPS systems. The first GPS based radiosonde system was installed at the Baltimore/Washington WFO in Sterling, VA in August of 2005.

Currently there are over 800 stations worldwide that release balloons for upper-air soundings. The NWS operates 92 of these stations with 69 in the conterminous US, 13 in Alaska, 9 in the Pacific, 1 in Puerto Rico, and 10 other stations in the Caribbean.

*** *Fun Fact: Relative humidity was recorded in early meteorographs by means of a strand of hair, preferably blond.***

Astronomy Happenings

Misty Duncan, Meteorologist Intern

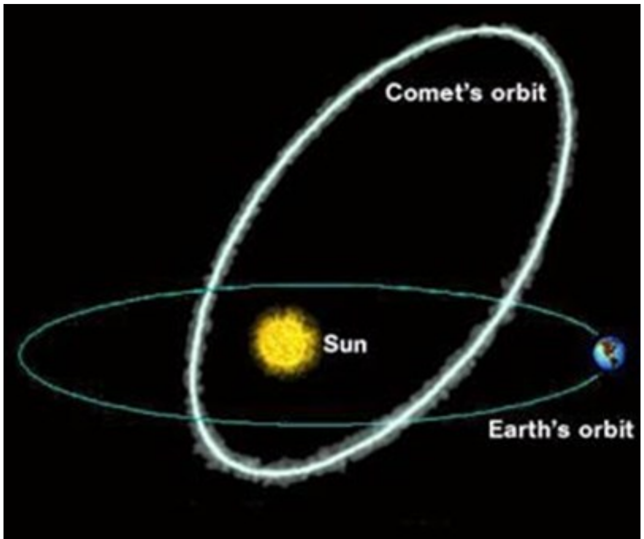
Perseid Meteor Shower

On a dark, moonless night, you can see between 50 to 100 meteors an hour during this show. The moon will be approaching the new moon phase, so this year it will only be a thin crescent that doesn't rise until just before sunrise. The thin moon will make for optimal viewing conditions, as long as the weather is cooperative of course. So grab a blanket, some company and find some open sky away from the city lights to enjoy the show!

What is a meteor shower?

A meteor shower is the result of the Earth crossing the orbit of a comet. For this shower, the comet is the Swift-Tuttle and the orbits intersect every year between July 14th and August 26th. When the comet is closest to the Sun, its heat causes pieces of the comet to break off, leaving behind debris of dust and rocks, a.k.a. meteors. As the Earth crosses the path of the comet, some of this debris smacks into the earth's atmosphere. The atmospheric gases cause the meteor to burn up and leave the "tail" you see on a "shooting star". The more debris in a comet's orbit, the better the chance of seeing numerous meteors during the shower.

Meteor showers are named for the constellation from which they originate. The Perseid meteor shower is named for the Perseus constellation because the tails of the meteors typically point back to this group of stars.

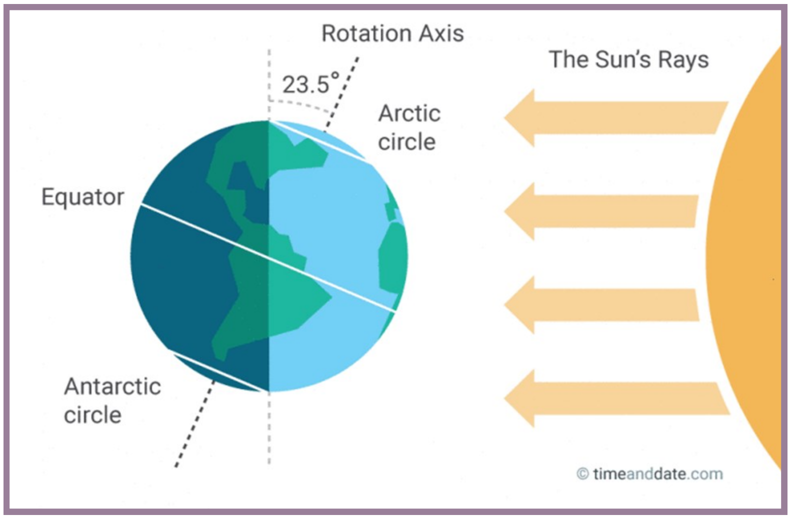


Depiction of Earth crossing the comet's orbit.

Sources: earthsky.org, spaceplace.nasa.gov

When: The mornings of August 11th-13th

Where: Look to the northeast after midnight for one of the best meteor showers visible in the northern hemisphere.



Picture shows the Earth's tilt in relation to the Sun. Notice how the northern hemisphere receives the most direct sunlight (summer) while the southern hemisphere receives the least direct sunlight (winter).

Summer Solstice

The summer solstice, the astronomical start of summer, fell on June 21st this year at 9:38 a.m. PDT. The word solstice comes from the Latin word "solstitium" which means sun-stopping. The summer solstice marks the time when the northern hemisphere has completely tilted toward the Sun. The sun's rays are most intense on the northern hemisphere and the position of the sun in the sky is at its farthest point north of the equator. After the summer solstice, the earth begins to tilt away from the sun until we reach the fall equinox and the beginning of fall. The summer solstice also marks the longest day of the year. On this day, there was over 15 hours of daylight in southwest Oregon! Compare this to the winter solstice on December 22nd when there is only 9 hours of daylight.

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Our Vision

Professionals focusing on science, teamwork, and customer service to design and deliver the best decision-support information to our community.

Our Mission

Our team at the National Weather Service Office in Medford strives to deliver the best observational, forecast, and warning information through exceptional customer service, extensive training and education, maintaining quality electronic systems, and relying upon an outstanding team of weather spotters and cooperative observers. We do this within the overall mission of the NWS to build a Weather-Ready Nation:

To provide weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

Our Values

Trust, Integrity, Professionalism, Service, Teamwork, Ingenuity, Expertise, and Enthusiasm.

About Us

The Weather Forecast Office in Medford, Oregon, is one of more than 120 field offices of the National Weather Service, an agency under the National Oceanic and Atmospheric Administration and the United States Department of Commerce. The Weather Forecast Office in Medford serves 7 counties in southwestern Oregon and 2 counties in northern California, providing weather and water information to more than a half-million citizens. We are also responsible for the coastal waters of the Pacific Ocean from Florence, Oregon, to Point St. George, California, extending 60 miles offshore. The office is staffed 24 hours a day, 7 days a week, and 365 days a year by a team of 26 meteorologists, hydrologists, electronic technicians, hydro-meteorological technicians, and administrative assistants, under the direction of Meteorologist-In-Charge John Lovegrove.